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smaller individuals resulting in a pronounced reduction in variability. The growth factor may be in wild cultures supplemented by racial heterogeneity.

*b. The Existence of an Assortative Mating.*—Pearl's conclusion that there is a real assortative mating in *Paramecium* is backed up in every point by Jennings's more detailed study. Large individuals conjugate with large, small with small. Pearl's five series gave positive values of  $r = .430$  to  $r = .794$ . Jennings's eight "wild" cultures of unknown racial composition all gave positive correlations of  $r = .245$  to  $r = .507$ .

In twelve lots of conjugants from "pure races" with correlations ranging from  $r = -.193$  to  $r = .507$ , there are ten positive and only two negative constants—both based on very small numbers and not statistically trustworthy with regard to their probable errors. The average of the twelve is  $r = .251$ . The correlation after separation of the pairs, is demonstrated to be greater than that determined on individuals which are united.

*c. The Causes of the Assortative Mating.*—Unquestionably, therefore, there is a real assortative conjugation. The redemonstration of the existence of a correlation between conjugants and the proof that it is not merely the result of heterogeneous cultures with only certain constituents in conjugation at one time is followed by a magnificent experimental-statistical analysis of the possible underlying factors. Equalization during mating, change of size during union, differential contraction due to killing fluid, environmental heterogeneity in the culture, are subjected to observation, experiment, measurement and statistical analysis. The specific results interest primarily the protozoologist. The broad and well-established conclusion is that the chief source of the correlation is, as Pearl five years ago maintained in *Biometrika*, a real assortative mating (larger individuals tending to conjugate with larger, smaller with smaller) arising in the fact that individuals must be of a certain degree of similarity in size to "fit."

*d. The Evolutionary Significance of (a)-(c).*—In connection with physiological differences resulting in different times of conjugation demonstrated by Jennings, the assortative conjugation is clearly a factor of the highest importance in the physiological isolation of the diverse races of *Paramecium*.

Apparently, the smaller size and lower variability of the conjugants have not a selective influence in maintaining the type of the population. The smaller extremes are, for the most part, younger than the conjugants, while the larger non-conjugants themselves conjugate after a few fissions. Moreover, the offspring of conjugants increase in size and in variability until they equal (or, in size exceed) the non-conjugants. Ex-conjugant offspring of individuals separated before completing conjugation.

Finally, the questions concerning the origin of heritable variations through conjugation within the "pure line," inextricably bound up as they are with the problem of the significance of conjugation, are reserved for a later paper. We are told, however, that heritable variations do, though rarely, arise as the result of conjugation within the "pure race."

Important as are the biological results of these two papers, their greatest value lies, not in concrete facts, but in their demonstration of the value of a widely applicable method. Let us hope they are only the beginning of the attack upon the many problems of morphology, physiology and genetics of the microorganisms which the biometric methods applied by Pearl and Jennings render possible.

J. ARTHUR HARRIS

#### "THE PASSING OF THE SLIME-MOULDS"

ON the first page of a late number of SCIENCE, April 13, appears the heading of a brief note entitled "The Passing of the Slime-moulds," by Professor C. E. Bessey. One who reads no farther, having in mind such titles as "The Passing of the Buffalo," "The Passing of the Chinese Empire," etc., might possibly infer that the slime-moulds were doomed

to speedy disappearance if not already gone. But such would be a serious error: the case is not so bad as that. These beautiful organisms were never more abundant than, nor did they ever receive such intelligent attention as, at the present moment. If the reader will leave the title-page and turn to the article itself he may, by reading a sentence or two, perhaps conclude that the "passing" in question is limited to the transit of thoughts about slime-moulds in the mind of our honored colleague during some thirty years. This is of course a matter of interest. We are glad to learn Professor Bessey's view even if inconstant, concerning any topic whatsoever. But we are still too hasty of conclusion. The "passing" intended is something different yet. Read to its conclusion the article in question would have us know that, in the judgment of the author, slime-moulds have finally passed from botany to zoology, have ceased to be plants (?) and have become animals—good riddance to them! Now in so much as our colleague esteemed does not at all trouble himself to define for us a plant or even an animal, the reader is left wondering; there rises the unbidden query: if we do not *know* what they are, why not let them alone, at least until we do know something definitive?

It appears, however, from the article, that DeBary, some half century ago, concluded the slime-moulds were not plants. It appears further that nothing has been added to DeBary's argument until the recent appearance in the *Encyclopædia Britannica* of an article on the *Mycetozoa*, where these are set forth as animals for the mere reason that the author of the contribution so esteems them. Professor Bessey agrees. The whole thing is a matter of opinion; each of us, so far as stated reasons go, may think as he will;—and there you are!

But since the encyclopedia article has been forsooth the cause provocative in the present instance, it may be worth our while to note for a moment the inspiration of that particular essay, that we may better realize the full weight attaching to the opinion so consoling to our Nebraska author.

The writer of the 11th-edition article bears a distinguished name. He is a zoologist, a collaborator of Professor E. R. Lankester for whose "Treatise on Zoology," now appearing, the younger man wrote a chapter on the *Mycetozoa*. For the "passing of the slime moulds" so far, therefore, we are indebted to the English professor, and it is worth while reading the introduction to what is to be his masterpiece, no doubt, to his "Treatise," in order to complete information at first hand.

This introduction to have *raison d'être* at all must evidently show something new. It is fair to state that the only novelty discoverable, aside from a multitude of unnecessary and hybrid terms, consists in the amount of botany offered, both in the introduction and in volume one. In the introduction the independent life of the green plant is emphasized at length, as matter heretofore strange to the zoological reader. The "subtle process" by which green plants take up N in the form of *ammonia* will come as information to botanists as well; while the statement that the animal depends for food upon "hydrocarbons" ought to be news even to zoologists.

That the earliest plants are to be traced to flagellate colony-building protozoa, similar to the *Volvocineæ*—here reckoned animals, of course—is also a contribution to botany deserving grateful recognition. But it is admitted that certain organisms "devoid" of chlorophyl are plants. Here belong "fungi, bacteria and a few others."

Autonomous fungi and the saprophytes depend for their food on the products supplied to them by the chlorophyl-holding cells of green plants.

Finally, the summary of zoological wisdom in this remarkable discussion appears in the following elegant sentence:

The colorless or greenless plants are descended from green chlorophylligerous ancestors: mouthless, gutless animals are descended from mouth-bearing, gut-hollow animals.

Now as above stated, the encyclopedia man prepared a chapter on *Mycetozoa* to follow in Vol. I. this erudite introduction. The slime-moulds are protozoa and come in for the present, until better accommodations are at

hand, between the *Heliozoa* and the *Radiolaria*. This, of course, need make little difference. The slime-moulds are "mouthless and gutless" and should go anywhere with that set. From just which, however, of the "mouth-bearing, gut-hollow" creatures such graceful forms as *Arcyria* and *Lamproderma* have descended will no doubt be made clear on some future page!

Such is the sort and kind of finished scholarship with which it is now sought to align American botanists.

But really does it much matter where these things are placed? For 150 years they have been handled by the botanist. If they are now to go to the zoologist, or the chemist, he must show some reason for his claim. Some day, refined research, perhaps by methods not now devised, will show more clearly lines of descent and so of genetic kinship. That day is not here yet—so far, at least, as is to be learned from authorities herein cited.

Meantime, it may be said in conclusion, the great collections on which the Oxford professor and his pupils have so gratuitously toiled, still occupy probably an honored alcove in the *herbarium* of the British Museum.

T. H. MACBRIDE

IOWA CITY,  
April 13, 1912

#### SCIENTIFIC BOOKS

*Meteorology*, a Text-book on the Weather, the Causes of its Changes and Weather Forecasting, for the Student and General Reader. By WILLIS ISBISTER MILHAM. The Macmillan Company. 1912.

As the author of this latest treatise on meteorology is a most popular professor of astronomy in Williams College it is natural that this book shall bear all the characteristics of an admirable text-book for class use. It is also intended for the general reader. It starts at the beginning and must be intelligible to all, but it has abundant references to current literature for the use of those who wish to study further. The author has not attempted the history of the science, nor the relations of climate to disease or plants, nor has he

laden his pages with heavy mathematical work nor with a dozen other special items that would be included in an encyclopedic treatise. Professor Milham's book is simply an enlargement of the lectures which he has been giving for the last eight years in Williams College which aims to give its students a broad education in languages and sciences that have to do with our every-day life. The genial generosity of the author is shown by his painstaking acknowledgment of every authority from whom he quotes and one might imagine the book to be a compilation were it not for the many good ideas originating with the author. As a popular text-book it is admirable and fills a want distinct from that which is satisfied by the excellent work of Davis. After four hundred pages devoted to the atmosphere and the weather bureaus the author adds a hundred pages, as part two, devoted to the climate, the floods, electric, optic and acoustic phenomena.

The great utility of reliable forecasts has undoubtedly always been an incentive to all mankind and throughout all ages to apply our crude scientific knowledge to the study of the atmosphere, but since the days of Galileo the love of knowledge for its own sake—the love of research into the hidden things of nature has been a characteristic of civilized man. The conflict between darkness and light, the contest between superstition and intelligence, the fight between conservatism and progress has nowhere been so persistent as during the past forty years and in the field of meteorology. Professor Milham is quite correct in saying that there is no subject wherein ignorance and superstition are more nearly universal than in connection with the weather. Perhaps we can not blame the well-educated citizens for a certain amount of ignorance since so little is taught about meteorology either in high schools or colleges. Apparently another century must elapse before courses of laboratory experimentation have been devised for use in our higher schools of science.

Our subject begins with the constitution of the atmosphere considered as a mixture of several gases and vapors; these are warmed by